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MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. LII. DECEMBER 11, 1891. No. 2

E. J. STONE, M.A., F.R.S., Vice-President, in the Chair.

Lord Edward Spencer Churchill, Castlemead, Windsor, was balloted for and duly elected a Fellow of the Society.

The following candidates were proposed as Fellows of the Society, the names of the proposers from personal knowledge being appended:—

Bertram Bennett, B.A., Paignton, South Devon (proposed by Edwin Dunkin);

Charles Bright, F.R.G.S., Assoc.M.Inst.C.E., M.I.E.E., Telegraph Works, Silvertown, Essex (proposed by the Earl of Crawford);

Charles Burckhalter, Assistant, Chabot Observatory, Oakland, California, 962 Chester Street, Oakland (proposed by W. M. Pierson);

Arthur Hilton Molesworth, B.A., Barrister-at-law, 15 Park Lane, W. (proposed by A. S. Herschel);

R. A. Sampson, B.A., Isaac Newton Student, St. John's College, Cambridge (proposed by A. M. W. Downing);

Charles Daulman Webb, B.A., B.Sc., Master in King's College School, 112 Adelaide Road, South Hampstead, N.W. (proposed by H. P. Hollis).

Sixty-five presents were announced as having been received since the last meeting, including, amongst others:—

Opere di Galileo, Edizione nazionale, vol. ii., presented by the Italian Government; Vienna Observatory, Annalen, Band VII., presented by the Observatory; Munich Observatory, Neue Annalen, Band II., presented by the Observatory; Paris Ob-

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servatory, Catalogue et Positions observées des Étoiles, vi^h à xii^h, presented by the Observatory; Philosophical Transactions of the Royal Society, vol. i., presented by C. L. Prince; two original negatives of the Moon, presented by the Lick Observatory; Leybourn, W., the Art of Dialling, 1682, Munster, S., Rudimenta Mathematica, 1551, and Sturmy, S., The Mariner's Magazine, 1669, presented by William Schooling.

On the Verification of the Expressions given in Delaunay's Lunar Theory by a Direct Differentiation and Substitution in the Differential Equations. By E. J. Stone, M.A., F.R.S.

In the *Monthly Notices* for November, Professor Cayley has shown by a direct differentiation of the expressions v, u, and $\frac{1}{r}$, given by Delaunay, that they satisfy the differential equations employed to the fourth order of the small fractions $\frac{n'}{n}$ or m, and for terms involving only e; and, if I understand the paper rightly, it is suggested that this method might be applied with success to test the general accuracy of Delaunay's expressions.

The general integration of the three simultaneous differential equations has been carried by Delaunay to the seventh order of the small fractions involved, whilst for certain terms, in which this degree of approximation was found insufficient, special investigations have been undertaken for the determination of the coefficients to much higher orders than the seventh; and the necessary transformations have been effected to give the expressions for v and u complete to the seventh order. But, because the inverse radius vector is ultimately multiplied by a comparatively small linear quantity, the radius of the Earth, and is compared directly with observation under the form of the Lunar Parallax, it has been thought sufficient to give the algebraical expression for $\frac{1}{r}$ only to the fifth order of small quantities; and the coordinates v, u, and $\frac{1}{r}$, as given by Delaunay, are therefore only complete to the fifth order. There would, however, be no very serious difficulty in effecting the necessary transformations and obtaining the expression for $\frac{1}{r}$ to the seventh order of small quantities, and this would render the expressions for v, u, and $\frac{1}{r}$, if accurate, complete to the seventh order. But the labour of extending these expressions generally to the high order of small quantities which has been found necessary for some terms would

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